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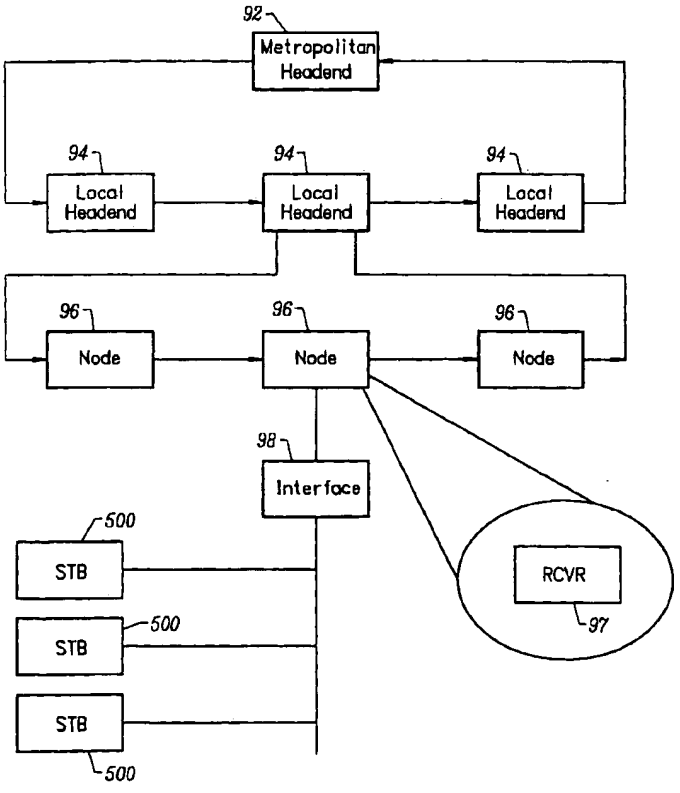
(54) Title: METHOD AND PROCESSOR ENGINE ARCHITECTURE FOR THE DELIVERY OF AUDIO AND VIDEO CONTENT OVER A BROADBAND NETWORK



(57) Abstract: A method and processor system for varying compression rates of video data, in response to variations in available bandwidth. The method involving spatial, non-spatial, and temporal compression, as well as, transmission of video and audio data over a broadband network (92-97), due to user instruction (98), to a remote location (500).

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :H04N 7/14
US CL :725/95; 375/240; 382/304

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 725/95; 375/240; 382/304

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X, Y	US 6,014,694 (AHARONi et al) 11 January 2000, col. 1, lines 45-50, col. 2, lines 10-40, col. 7, lines 61-67, and col. 8, lines 1-23.	1, 14-17, 20-26, 30-33, 36-41, 57, 63-68, 71, and 74
X, Y	US 6,351,471 B1 (ROBINETT et al) 26 February 2002, col. 2, lines 26-51.	2-13, 18, 19, 27-29, 34, 35, 58-62, 69, 70, 72, and 73
Y	US 5,461,679 (NORMILE et al) 24 October 1995, col. 9-11, lines all.	41-57, 71, 74-92
A	US 5,838,678 (DAVIS et al) 17 November 1998, All.	1-92

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

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Form PCT/ISA/210 (second sheet) (July 1998)★

57. A method of delivering video content through a residential broadband network, comprising:

receiving a request for video content from a remote client;

establishing an application session on a first processor, and within the first processor,

accessing a video content source to retrieve the requested video content;

compressing the retrieved video content to create a spatially compressed frame of video content ,

signaling to a second processor of the existence of the spatially compressed frame of video content,

and within the second processor;

temporally, compressing the spatially compressed frame of video content to create at least one temporally compressed frame of video content;

joining the spatially compressed frame of video content with the temporally compressed frame of video content to create a data stream of compressed video content;

outputting the data stream of compressed video content to the remote client.

58. The method of Claim 57, further comprising the step of,

communicating a combination of a unique channel and Program Identifier that carries the data stream of compressed video content to the remote client.

59. The method of Claim 58, wherein the spatially compressed frame of video content comprises an MPEG2 I-frame.

60. The method of Claim 58, wherein

the at least one temporally compressed frame of video content comprises an MPEG2 B-frame.

61. The method of Claim 58, wherein

the at least one temporally compressed frame of video content comprises an MPEG2 P-frame.

62. The method of Claim 58, wherein

the data stream of compressed video content comprises an MPEG2 Transport Stream Group of Pictures.

63. The method of Claim 57, wherein

the application session on the first processor comprises an Internet application session.

64. The method of Claim 63, wherein

the Internet application session comprises a Internet Browser application session.

65. The method of Claim 57, wherein the step of accessing a video content source to retrieve the requested video content further comprises,

accessing a switched network to retrieve the requested video content.

66. The method of Claim 65, wherein

the switched network comprises the Internet.

67. The method of Claim 57, wherein the step of accessing a video content source to retrieve the requested video content further comprises,

accessing a video-on-demand server to retrieve the requested video content.

68. The method of Claim 57, wherein

the broadband network comprises a cable-television residential broadband network.

69. The method of Claim 57, wherein the step of signaling to the second processor of the existence of the spatially compressed frame of video content comprises,

outputting from the first processor, the spatially compressed frame of video content, to the second processor.

70. The method of Claim 57, wherein the step of signaling to the second processor of the existence of the spatially compressed frame of video content comprises,

depositing from the first processor to a memory location the spatially compressed frame of video content, and;

setting an update flag associated with the memory location.

71. A method of delivering motion video or audio content through a broadband network, comprising:

receiving a request for motion video or audio content from a remote client;

establishing an application session on a first processor, and within the first processor,

accessing a motion video or audio content source to retrieve the requested motion video or audio content;

rendering a frame of video that contains a display window with coordinates;

signaling to a second processor of the existence of the motion video or audio content and the coordinates,

and from the second processor;

outputting the data stream of compressed motion video or audio content to the remote client for display within the coordinates of the display window.

72. The method of Claim 71, wherein,

the data stream of compressed motion video or audio comprises an MPEG2 Transport Stream.

73. The method of Claim 72, further comprising the step of,

communicating a combination of a unique channel and Program Identifier that carries the data stream of compressed motion video or audio content to the remote client.

74. A processing engine for the delivery of video content through a broadband network, comprising:

a first processor, that is under program control to, access and retrieve video content requested by a remote client through the broadband network, and spatially compress the retrieved video content to form a spatially compressed frame of the video content; coupled to

a second processor, that is under program control to, temporally compress the spatially compressed frame of the video content to form a plurality of temporally compressed frames representing the video content, and merge the spatially compressed frame of the video content and the plurality of

the temporally compressed frames of the video content to render a stream of compressed frames representing the video content.

75. The processing engine in Claim 74, wherein,

the first processor and the second processor each belong to at least one processing node within an N^M array of processing nodes, where N refers to the number of processing nodes within a processing node row or column and M refers to the number of orthogonal dimensions of the array of processing nodes.

76. The processing engine in Claim 75, wherein,

N is at least four and M is at least two.

77. The processing engine in Claim 75, wherein,

each of the processing nodes are orthogonally coupled and support bi-directional communications between orthogonal processing nodes.

78. The processing engine in Claim 77, wherein,

each processing node comprises M*(N-1) communication ports that are coupled with the communication ports of the orthogonal processing nodes.

79. The processing engine in Claim 77, wherein,

bi-directional communication between processing nodes comprises traversal of the physical transport layers of the processing nodes.

80. The processing engine of Claim 79, wherein,

the physical transport layer consists of a physical media selected from the group consisting of;

fiber-optics, a databus, twisted pair, or microwave wave guide.

81. The processing engine of Claim 75, wherein

each processing node comprises at least a bi-directionally coupled pair of processing units.

82. The processing engine of Claim 81, wherein

each processing unit comprises a bi-directionally coupled dual-CPU within the same package.

83. The processing engine of Claim 81, further comprising,

a communications processing unit that is bi-directionally coupled to the processing units.

84. The processing engine of Claim 75, wherein,

at least a portion of the processing nodes are each under program control to, exclusively access and retrieve through a switched network video content requested by a plurality of remote clients, and spatially compress the retrieved video content to form the spatially compressed frame of the video content

85. The processing engine of Claim 75, wherein,

at least a portion of the processing nodes exclusively temporally compress the spatially compressed frames of the video content requested by the plurality of remote clients to form the plurality of temporally compressed frames representing the video content, and merge the spatially compressed frame of the video content and the plurality of the temporally compressed frames of the video content to render the stream of compressed frames representing the video content.

86. The processing engine of Claim 84, wherein,

at least one processing node performs a load balancing function to equally distribute the plurality of remote clients requests across the portion of processing nodes.

87. A processing engine architecture for use with the delivery of audio or video content over a broadband network, comprising:

an N^M array of processing nodes, where N is the number of processing nodes along M dimensions of the array of processing nodes; each processing node further comprising;

M*(N-1) communication ports that are bi-directionally coupled to the communication ports of orthogonally situated processing nodes.

88. The processing engine architecture in Claim 87, wherein,

at least a portion of the processing nodes further have at least an additional communication port that is connectable to an external switched network.

89. The processing engine architecture in Claim 87, wherein,

processing nodes are bi-directionally coupled using at least one physical media selected from the group consisting of; microwave wave guides, fiber, a databus.

90. The processing engine architecture in Claim 87, wherein,

communication between the processing nodes comprises traversal of the physical transport layer of the processing nodes.

91. The processing engine architecture in Claim 87, wherein,

at least a portion of the processing nodes comprise a pair of bi-directionally coupled processing units.

92. The processing engine architecture in Claim 91, wherein,

the bi-directionally coupled processing units comprise dual-CPU within the same physical package.